

Oral Papers

Structural, Photocatalytic, and Dielectric Properties of Glass-Ceramics

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Abstract: Glass-ceramic materials have attracted significant interest due to their tunable structure and multifunctional properties, making them suitable for advanced technological applications. In this study, glass-ceramics were synthesized using the melt-quenching method followed by controlled heat treatment to induce crystallization. Structural investigations were carried out using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM), revealing the formation of well-dispersed crystalline phases embedded within an amorphous glassy matrix.

The photocatalytic performance of the glass-ceramics was evaluated through the degradation of organic dye under UV and visible light irradiation. The results demonstrate enhanced photocatalytic activity compared to the parent glass, which is attributed to improved charge separation, increased surface reactivity, and the presence of photoactive crystalline phases. Additionally, dielectric measurements performed over a wide frequency and temperature range indicate frequency-dependent dielectric behavior, characterized by high dielectric constant values at low frequencies and reduced dielectric losses at higher frequencies.

The correlation between structural evolution, photocatalytic efficiency, and dielectric properties highlights the crucial role of controlled crystallization in optimizing the functional performance of glass-ceramics. These findings suggest that the developed glass-ceramic systems are promising candidates for multifunctional applications, including photocatalysis, optoelectronic devices, and dielectric components.

Keywords: Glass-ceramics, Structural properties, Photocatalysis, Organic dye degradation, Dielectric behavior.

References

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